

# Enkagrid®

SOIL REINFORCEMENT



Soil reinforcement on a roll

COLBOND

# Enkagrid

## The Family

To help engineers around the world respond to demanding construction and maintenance challenges, Colbond has developed a family of certified high-performance engineered soil reinforcement products - the Enkagrid range of welded geogrids.

The geogrid comprises distinctive precision-manufactured high-tensile extruded polymer bars bonded in a regular lattice that delivers high-integrity and cost-effective performance. In many major projects around the world Enkagrid has been employed to build demanding geotechnical structures, with contractors benefiting from the product's ease of handling, competitive price and excellent long-term performance.

The expanded Enkagrid family is the result of more than a decade of research, with a continual design and development program backed by extensive independent testing and certification. Colbond offers exceptional product support, ranging from unique design software to application-specific advice from the company's experienced engineers.

### Colbond

Colbond is a globally active producer of high quality products for civil engineering applications including drainage, erosion control, landfill applications, soil reinforcement and soil improvement. The wide range of geosynthetics includes Enkamat®, Enkadrain®, Enkagrid®, and Colbondrain®.

The company is also a leading producer of high performance polyester nonwovens for the flooring, automotive and construction industries.

Colbond is headquartered in Arnhem, the Netherlands and has production facilities in the Netherlands, Germany and the United States. Regional sales offices are located all over the world.

The company is part of the Technical Textiles division of the worldwide operating Low & Bonar group.

## Applications



airport runways



bridge abutments



structural foundations



car parks



construction haul roads (unpaved)



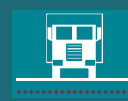
embankments



mining areas



paved roads



permanent unpaved roads



piled embankments

# Enkagrid

Offering ease of design, handling and installation with long-term performance and minimum risk, Enkagrid geogrids save time and money throughout a project's lifetime, making unusable sites and soils practical and extending the working life of structures.

## PRO

**Enkagrid PRO** is a uniaxial geogrid of extruded polyester bars available in a number of different strengths.

The product offers a **PRO**fessional solution with unparalleled strength, performance and reliability for the reinforcement of slopes, walls and embankments. The structure of highly oriented laser-welded polyester bars provides powerful and dependable reinforcement in demanding applications. Purpose-developed design software backed up by our free design service ensures that Enkagrid PRO meets any challenge.

## MAX

**Enkagrid MAX** is a biaxial geogrid of extruded polypropylene bars, available in a number of different strengths in both axes.

The product delivers **MAX**imum cost-effective performance for sub-base stabilization beneath construction roads and parking areas. The unique laser-bonded structure gives rigid junctions with consistent stress-strain performance throughout the matrix. For high-speed installation with consistent long-term high performance due to high passive bearing resistance and optimum soil interaction, Enkagrid MAX is the solution for permanent and temporary roadway projects.

## TRC

**Enkagrid TRC** is a proven multifunctional geogrid composite with the same strength in both axes.

The product delivers reinforcement, separation and filtration in one easy to install product for paved roads, parking areas and platforms. It reduces the required sub-base thickness and increases road life, due to a unique combination of high-modulus low-elongation Twaron® aramid fibers embedded in a Colback® polyester nonwoven. The nonwoven prevents mixing of fill and subsoil for a long-term consistent, high-performance solution.

## PRO



## MAX



## TRC



### The Enkagrid family delivers:

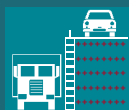
- Reinforcement for all soil structures
- A perfect combination of geometry and polymers to create the optimum soil-grid interaction for all types of soil
- Excellent mechanical long-term durability based on high quality
- Ease of handling and installation
- Proven design programs, a free design service and technical backup, for a reliable effective design
- A wide choice of products to suit your needs



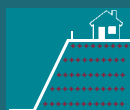
basal reinforced platforms



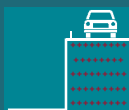
railways



segmental retaining walls



steep slopes



walls



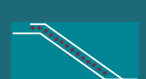
container terminals



landfill capping



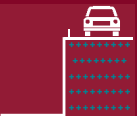
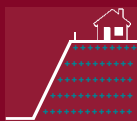
landfill foundation



topsoil stabilization

# Enkagrid PRO

## Applications



Enkagrid PRO is a uniaxial polyester geogrid, available in a number of different strengths, ensuring a precisely engineered solution for each specific application. Enkagrid PRO's uniaxial design with color-identified polyester bars ensures correct installation as a powerful reinforcement in slopes, vegetated and segmental block walls, abutments, embankments, platforms and in the foundations of buildings and structures.

Enkagrid PRO offers:

- High-performance soil reinforcement
- Excellent durability and long-term performance
- Ideal interaction with all soil types due to its innovative structure
- Fast and easy installation with 5 m wide rolls



The Netherlands, Emmen: Steep wall using Enkagrid PRO and Enkamat 7210



Switzerland, Verbier: Gabion retaining wall reinforced with Enkagrid PRO 40

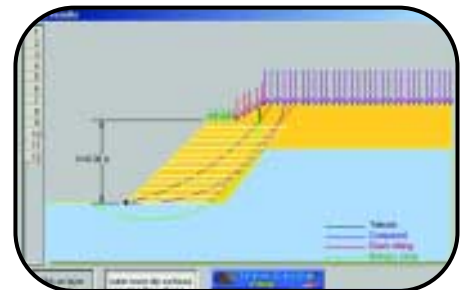
For **reinforced slopes**, Enkagrid PRO's geometry and ideal soil-grid interaction creates an anchoring effect and allows designers to increase the slope angle, saving space at the foot of the slope.

The same benefits deliver greater design freedom and options for **retaining walls and segmental block walls**.

When used as **base reinforcement** Enkagrid PRO increases the bearing capacity of an embankment or platform on marshy soils. It delivers extra stiffness to prevent differential settlement during consolidation and prevents sliding by increasing the external stability.

As a high-performance **foundation of buildings and structures**, Enkagrid PRO prevents differential settlement by forming a stiff raft, cutting the need for complex and costly piling operations.

[www.enkaslope.com](http://www.enkaslope.com)



Building on years of research, Colbond's engineers have developed a number of user-friendly and proven design programs. The program available for designing the reinforcement in slopes, walls and abutments is **EnkaSlope** - a software tool based on established design methods and existing programs. Access to this design software can be obtained free of charge at [www.enkaslope.com](http://www.enkaslope.com).

# Enkagrid MAX

**Enkagrid MAX is a cost-effective biaxial polypropylene geogrid that delivers the high performance expected of Colbond's products. Enkagrid MAX is ideal for subbase stabilization, typically on paved and unpaved roads. Delivered to site in 5 m wide rolls, Enkagrid MAX is easy to handle and install correctly, and suits permanent and temporary works.**

Enkagrid MAX is:

- Suitable for sub-base stabilization with MAXimum performance at the right price
- Designed for maximum bearing capacity and shear resistance
- Delivered in 5 m wide rolls for easy handling on site and fast installation



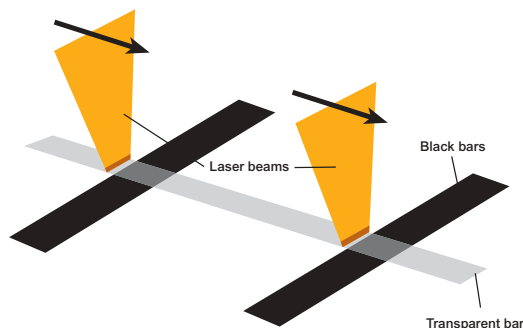
Poland, Żywiec: Sub-base stabilization (Enkagrid MAX)



Hungary, highway Görbehaza (Enkagrid MAX 30)

Its unique high-precision laser-bonded structure of chemically inert extruded polypropylene bars delivers high resistance to UV degradation, elevated passive bearing resistance and optimum interaction with all soil types.

For consistency and reliability, Enkagrid MAX is the logical choice to deliver MAXimum performance at the right price on construction challenges in soft soils around the world.



The engineered structure of Enkagrid geogrids applies cutting-edge manufacturing concepts such as the patented computer-controlled laser welding process. Using laser technology the quality of the junction bonds is precisely controlled during the production process. This creates consistently rigid joints throughout the geogrid without affecting the polymer orientation or stress-strain performance of the extruded bars.

## Applications



# Enkagrid TRC

## Applications



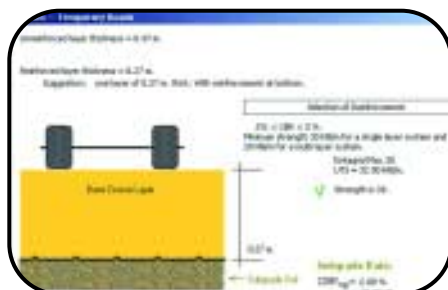
**Enkagrid TRC is a high-modulus multifunctional geogrid composite. It strengthens weak or poor subgrade soils, and is also suitable for reinforcing the aggregate base course in paved or unpaved roadways, parking areas, small embankments, building foundations and platforms. The innovative multifunctional geogrid composite is formed with Twaron® aramid fibers embedded in a Colback® polyester nonwoven to reinforce the structure and separate differing soil types.**

### Enkagrid TRC offers:

- Reinforcement, separation and filtration in one product
- One-step easy installation
- High modulus, low strain - mean value 3.5%
- Proven results on construction sites around the world

The Twaron® component, typically five times stronger than steel, has a unique blend of mechanical properties with high modulus and low elongation (approximately 1.5% under working loads and 3.5% at break) so that high tensile forces are mobilized with minimal deformation of the subbase. As a result, cracks propagate more slowly into the road surface, leading to extended service life.

[www.enkaroad.com](http://www.enkaroad.com)



Based on existing design methods, established theories and extensive field trials Colbond has developed design software for reinforced roads. Named **EnkaRoad**, the program is suitable for both Enkagrid MAX and Enkagrid TRC and covers reinforced unpaved and paved roads. Available online or on CD-ROM, EnkaRoad allows design engineers to select specific soil parameters, surface layers and traffic intensities.

The Colback® nonwoven performs separation and filtration functions, preventing both pumping of fines from the subsoil into the roadbase and mixing of fill and subsoil.

Designs using Enkagrid TRC offer cost savings in construction and maintenance due to reductions in roadbase thickness, improved roadbase drainage, lower deformation and a longer service life.



France, Lyon: Soil stabilization construction of a car park (Enkagrid TRC 30)



New Zealand, Auckland: Construction haul road using Enkagrid TRC 30

# Enkagrid

## Case Studies



### Reinforced wall Montbéliard, France

Montbéliard, France is home to one of the many projects worldwide relying on Enkagrid PRO. Here it was used to build a steep wall to form an aesthetically appealing green face in a new residential area. With a face angle of 65°, a wall length and height of 130m and 4,20m respectively, this project called for a geogrid providing reliable soil reinforcement and durability for long service life. The project team chose Enkagrid PRO 40 for its technical design strength, cost effectiveness and ease of handling. And Colbond's design support was also considered a 'PRO'.



### Segmental retaining block wall Monaghan, Ireland

Segmental block walls are enjoying increasing popularity as they offer significant advantages over conventional retaining structures. They are low cost and fast to build, provide great safety during construction and create aesthetically appealing surfaces. At Monaghan, a nine meter high wall was built with a face angle of 87° and a surface area of 500m<sup>2</sup> to facilitate the construction of apartment blocks. The BBA approved system applied a combination of Anchor Landmark blocks in conjunction with Enkagrid PRO for maximum design strength and reliable reinforcement.



### Paved road Las Vegas, USA

Paved streets in a residential area of Las Vegas, originally laid directly on soft subgrade, were cracking and rutting badly. The city's engineers decided to relay the road with reinforcement to extend its load-bearing capacity and working life, but wished to minimise construction time to avoid inconveniencing residents. 45,000 sqm of Enkagrid MAX were laid with a separation geotextile providing a durable and strong sub-base for the new road surface in minimum time.



### Production platform Niepolomice, Poland

Near Kraków, almost 200,000 m<sup>2</sup> of Enkagrid MAX were used to enable the construction of a big new factory for commercial vehicle manufacturer MAN. Production halls and parking lots had to be built on low bearing capacity sub-grade. To create a durable foundation, major clay layers were replaced with gravel. Laid between these mineral layers, Enkagrid provided the strength needed to reduce the shear stress on the sub-base and stabilize the platform for a long service life.

# Enkagrid

## The Product Range



Enkagrid PRO block wall connection detail



Germany, Altentreptow:  
Car park



All Enkagrid geogrids are rigorously tested in Colbond's own laboratories. If required, certification to relevant national and international standards is obtained from independent organisations such as tBU (Germany), L.I.R.I.G.M. (France) and TRI (United States).



The Quality Management of Colbond Geosynthetics, at Arnhem (development and sales) and Obernburg (production), has been approved by Lloyd's Register Quality Assurance Limited to the NEN-EN-ISO 9001:2000 quality management system standard (Certificate No. 935136). All Enkagrid types are CE-certified by a notified body (no. 0799-CPD). From raw material through manufacture, shipping, on-site storage, installation and service, Enkagrid products benefit from Colbond years of experience and extensive resources.

Enkagrid PRO (uniaxial geogrid)	Nominal strength (kN/m)	Polymer
PRO 40	40	PET
PRO 60	60	PET
PRO 90	90	PET
PRO 120	120	PET
PRO 180	180	PET

Enkagrid MAX (biaxial geogrid)	Nominal strength (kN/m)	Polymer
MAX 20	20	PP
MAX 30	30	PP
MAX 40	40	PP

Enkagrid TRC (multifunctional biaxial geogrids)	Nominal strength (kN/m)	Polymer
TRC 30	30	aramid + PET

All values are mean values.

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